PROTECTIVE IRRIGATION WORKS,
RAJPUTANA.

REPORT

ON THE

BALDAH NULLAH DIVERSION PROJECT

IN THE

SIROHI STATE.

1905.

AJMER.

INDEX.

Para.		Page
1.	Project described	1
2.	Catchment Area and Water available for Storage ...	1
3.	Dam	1
4.	Water-spread and Capacity	1
5.	Maximum Discharge	2
6.	Supply Cut	2
7.	Discharge of Supply Cut	2
8.	Time Tank will take to fill with maximum Discharge ..	2
9.	Estimate of Cost	3
10.	Increase to Water Supply of Sirohi City...	4
11.	Preparation of Project	4
12-15.	Specification	4

ABSTRACT ESTIMATE OF COST.

PLANS.

I.—Contour Plan and Plan Longitudinal Sections and Cross Sections of Dam.

II.—Longitudinal Sections and Cross Sections of Supply Channel

REPORT.

Project described.

The Baldah Nullah rises on the east slope of the hills behind Sirohi town, and flows from west to east towards the Western Banas, on the plateau above the town. During the Famine, when the new tank at Sirohi was started, it was also proposed to increase its catchment area by constructing a dam across the Baldah nullah near Baldah village, and by a cut divert the water back into a natural nullah which is in the catchment area of the new tank. The cut was commenced and partly carried out in the Famine, but nothing else was done, nor was the project surveyed, or worked out in detail.

The site was inspected by the Consulting Engineer, who fixed the best place for the diverting bund; and as a good deal of work had been done already, thought it advisable to have Plans and Estimate prepared for completing it.

Catchment Area and Water available for Storage

2 The catchment area at the site of the proposed diverting bund is $3\frac{1}{8}$ square miles, and as this is hilly, 20 per cent. of the average rainfall of $23\frac{1}{2}$ inches, or 34·27 m.c.ft. of water, should be available for storage.

Dam.

3 The dam will be entirely of earth, starting from the low hills on the right bank of the main nullah, just below the supply cut, to the high ridge on the left bank, then turning west across the tributary nullah, the dam will end at the hill on the left bank of this nullah. Two small tanks will be formed, and a cut will have to be made in the centre ridge (C D, see plan) to connect the two.

The dam has a total length of 1,100 r.ft., and assuming the bed level of the supply cut at starting to be R.L. 100, the crest of the dam will be R.L. 115, or 5 ft. above the full supply level of the cut.

The top width will be 8 ft., with a front slope of 3 to 1 pitched up to R.L. 112, and a rear slope of 2 to 1.

Water-spread & Capacity

4. The following is the water-spread and capacity of the proposed Tank at R.L. 105 and 110 :—

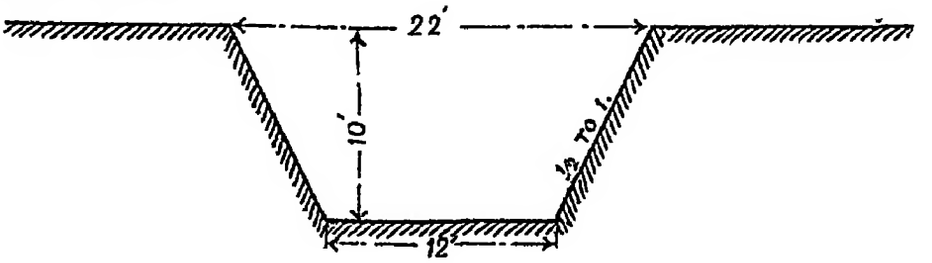
R.L	Water-spread in s.ft.	Capacity in m.c.ft.
110	1,250,000	
		4·15
105	410,000	
		·65
100	.....	
		4·83

a ·ıum scharge

5. The maximum discharge on the catchment area of $3\frac{1}{8}$ square miles is (Dickens formula) 1930·5 cusecs

pply Cut.

6. It is proposed to complete the supply cut by making it of the following section :—



The total length is 2,820 r.ft. and the fall in this length 2 ft. The earth excavated will be thrown up in a bank on the lower (west) side so that all the surface drainage on its course may also be caught and diverted down the cut.

This bank will start 5 ft. from edge of cutting, with a slope of 2 to 1 (see Plan No. 2). Where the ground surface is lower than R.L. 110 (full supply level of channel) the inner slope of the bank will be pitched up to R.L. 111, with a layer of 1 ft. of dry stone on 6 inches of kunkar or chips, to prevent the bank cutting away by the water passing down the channel.

Discharge of Supply Cut.

7. The discharge by this channel for each foot (by Kutter's formula) is given in the following table :—

R L	Area in s ft.	Velocity in ft per second.	Discharge Cusecs
R.L. 101	12·5	1·74	21·75
,, 102	26·0	2·42	63·02
,, 103	40·5	2·70	109·35
,, 104	56·0	3·80	214·37
,, 105	72 5	4·34	314 57
,, 106	90·0	4·73	425·70
,, 107	108 5	5·06	549·00
,, 108	128·0	5·40	691·20
,, 109	148·5	5 70	846·45
,, 110	170·0	5·93	1007·76

Time Tank will take to fill with maximum Discharge.

8. This supply cut is the weir of the tank.

(a) Supposing the tank to be empty, and the maximum discharge from the catchment area, of 1930·5 cusecs, to occur, the tank will fill up to R.L. 105 in—

$$T = \frac{\text{Capacity}}{1930{\cdot}5} \quad \text{Sec.} \quad \frac{6,80,000}{1930{\cdot}5} = 352 = 5 - 52 \quad \text{M. Sec}$$

During this period the cut will have discharged—

$$\frac{72,306}{5} \quad \text{Discharge} = \frac{\text{Mean Discharge (C Ft per Sec.}}{144{\cdot}6} \times 352 = 50,899 \quad \text{Sec} \quad \text{C Ft}$$

so that the tank will have only stored 629,101 c ft.

(*b*) Up to R.L. 110 the capacity still available is therefore—

4,150,000 c.ft. + 50,899 c.ft. = 4,200,899 c.ft.

Supposing the maximum flood still to continue, the time required to fill this is—

$$T = \frac{4,200,899}{1930\cdot5} = 2,176 \text{ sec} = 36 \text{ M.} - 16 \text{ sec}$$

During this period the cut will have discharged—

$$\frac{\text{Discharge}}{5} = \frac{3520\cdot11}{5} = 704\cdot02 \times 2176 \text{ sec}$$

$$= 1531947\cdot5 \text{ c ft.}$$

so that the tank will have stored only 4,150,000 − 1,531,947·5 = 2,618,052·5 c.ft., which is the capacity of the tank a little below R.L. 109, or 1 ft. more has to be filled.

(*c*) The time required to fill this extra foot is—

$$T = \frac{1531947\cdot5}{\text{Discharge. } 1930\cdot5 - \text{Mean discharge. } 927\cdot10}$$

$$= \frac{1531947\cdot5}{1003\cdot4}$$

$$= 1516 \text{ sec.} = 25 \text{ M.} - 16 \text{ sec.}$$

(*d*) The total time in which it will take to fill the tank to R.L. 110 with the maximum flood is therefore—

H.	M.	Sec.
0	5	52
0	36	16
0	25	16
1	7	24

The maximum flood is never likely to last so long continuously, therefore the size of the supply channel as proposed may be accepted as sufficient for safety.

9. The estimated cost of the Project is :—

		Rs.
(1)	Dam	2,626
(2)	Supply Cut	2,365
(3)	Contingencies	219
		5,240

This does not include the previous expenditure incurred during the Famine.

Increase to Water Supply of City

10. No extra Revenue is likely to be obtained, but the work, like the completion of the New Tank itself, must be treated as an addition to the water supply of Sirohi city; and this is badly needed.

Preparation of Project.

11. The Surveys and plans have been prepared by S. O. Luxmi Narain under the directions of the Superintending Engineer, Protective Irrigation Works.

SPECIFICATION.

Dimensions

12. All the dimensions of the dam and supply cut are given in the Plans and Estimate, which are to be strictly adhered to.

Marking out.

13. The centre line and slopes to be marked out with trenches 1 ft. broad and 1 ft. deep, showing permanently the inner and outer slopes, and breadth of top of the embankment.

Earthwork.

14. The old surface to be picked up for at least 9 inches, and all grass and roots removed before new earthwork is commenced.

The embankment to be carried out in layers not exceeding 9 inches in thickness, carefully consolidated.

All the layers to be laid concave, that is lower in the centre. No clods of earth should on any account be allowed in the embankment. No earth to be excavated within 100 ft. of either toe of the slopes.

Pitching

15. The surface of the inner slope of dam, and portions of the bank of supply cut, to be pitched to 2 ft. below crest, with a layer of dry rubble stone 1 ft. thick on 6 inches of kunkar or chips.

F. St.-G. MANNERS SMITH,
Superintending Engineer,
Protective Irrigation Works, Rajputana.

Ajmer,
31*st March* 1905

Abstract Estimate of Cost.

BALDAH NULLAH DIVERSION PROJECT in the SIROHI STATE.

Quantity or Number.	Items.	Rate.	Per	Amount	Total
		Rs. A.		Rs.	Rs.
	(1) EARTHEN DAM.				
406,766 c.ft.	Earthwork ...	5—0	c. ft. 1000	2034	
19,734 s.ft.	Pitching ...	3—0	c. ft. 100	592	
					2,626
	(2) SUPPLY CHANNEL.				
186,220 c.ft.	Excavation, including soft rock cutting ...	10—0	c. ft. 1000	1862	
16,750	Pitching ...	3—0	c. ft. 100	503	
					2,365
					4,991
	Contingencies @ ...	5—0	cent.	...	249
	GRAND TOTAL ...	...	...	...	5,240